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SUBMISSION OF TRANSLATION OF PRIORITY DOCUMENT

Enclosed please find a translation of priority document DE 103 07 145.8.

Respectfully submitted,
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TRANSLATION CERTIFICATION

This is a complete and accurate translation by us, to the best of our knowledge and ability, from German into English of:

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Date: 2/7/04

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FRICTION CLUTCH

SPECIFICATION

The present invention pertains to a friction clutch comprising

-- a housing arrangement, which is or can be connected to a drive element for rotation in common around an axis of rotation;

-- a plurality of first friction disks, which are connected to the housing arrangement for rotation in common around the axis of rotation and are able to shift relative to the housing arrangement in the direction parallel to the axis of rotation;

-- a plurality of second friction disks, which are connected to a hub for rotation in common around the axis of rotation and are able to shift relative to the hub in the direction parallel to the axis of rotation, where the hub has a plurality of radially outward-projecting rotational connection arms, which engage with the second friction disks for rotation in common with the hub; and

-- a force-exerting arrangement, under the action of which the first friction elements and the second friction elements can be brought into frictional contact with each other.

A friction clutch is known from DE 198 21 654 A1, in which three ring-shaped, disk-

like friction elements are connected nonrotatably to a hub. For this purpose, the hub has radially outward-projecting rotational connection arms, which thus give the hub an essentially star-like configuration. The friction elements connected to this hub have corresponding, inward-projecting rotational connection arms, so that in this way they can be connected to the hub in a way which does not allow relative rotational movement but which does allow movement in the axial direction.

A friction clutch is known from US 4,846,326, i.e., from US RE 36,363 , in which the hub also has a plurality of radially oriented rotational connection areas or rotational connection arms proceeding from a radially inner, ring-like area for the friction disks to be connected to it. The axial dimension of the rotational connection arms corresponds to the radial dimension of the ring-like area of the hub situated radially inside them. In the areas between directly adjacent rotational connection arms, walls are provided to bridge the gaps in the circumferential direction. These walls are much thinner in the axial direction than the rotational connection arms and are more-or-less centered -- again relative to the axial direction -- with respect to the rotational connection arms. These walls are located between two friction disks to be connected nonrotatably to the hub; as a result, these walls, which extend radially outward to the exact same extent as the rotational connecting arms, serve to retain the hub axially with respect to the friction disks.

DE 198 10 981 A1 discloses a friction clutch, i.e., a hub for such a clutch, in which the axial fixation of the hub with respect to the friction disks to be connected nonrotatably to it is also accomplished in the radial area of the rotational connection arms. For this purpose, it is possible, for example, to provide a circumferential web or a circumferential wall on one axial side of these rotational connection arms and to provide a securing disk on the other axial side.

In the new drive systems being developed for use especially in racing vehicles, but also to an increasing extent in ordinary vehicles, the torques which must be transmitted are continually increasing. These torques must be transmitted via the friction clutches, which means that the friction clutches are subjected to very high loads. This leads to stability problems, especially in the area where various components are connected to each other for the transmission of torque.

The task of the present invention is to improve the friction clutch of the type described above in such a way that it is suitable for the transmission of higher torques.

This task is accomplished according to the invention by a friction clutch comprising

-- a housing arrangement, which is or can be connected to a drive element for rotation in common around an axis of rotation;

-- a plurality of first friction disks, which are connected to the housing arrangement for rotation in common around the axis of rotation and are able to shift relative to the housing arrangement in the direction parallel to the axis of rotation;

-- a plurality of second friction disks, which are connected to a hub for rotation in common around the axis of rotation and are able to shift relative to the hub in the direction parallel to the axis of rotation, where the hub has a plurality of radially outward-projecting rotational connection arms, which engage with the second friction disks for rotation in common with the hub; and

-- a force-exerting arrangement, under the action of which the first friction elements and the second friction elements can be brought into frictional contact with each other.

It is also provided that at least one of the second friction disks has engagement openings closed off radially on the inside, in which openings the rotational connection projections on the

rotational connection arms of the hub engage.

The area of the connection between the second friction disk and the hub is especially critical, because this connection is established on a diameter which is smaller than that on which the first friction disks are connected to the housing arrangement. There is thus always less room available in this radially farther-inward area to accommodate the connection, which means that there will always be very high loads on the components here. According to the invention, however, at least one of the second friction disks does not have an essentially arm-like or star-like configuration radially on the inside, but rather only openings in certain areas for establishing the rotational connection. As a result, this part of the disk is very strong. There is thus no danger that excessive torsional load could cause this friction disk to become undesirably deformed.

In the friction clutch according to the invention, it is preferable for at least one of the second friction disks to have engagement openings which are closed off at the radially inner ends. The rotational connection projections on the rotational connection arms of the hub engage in these openings.

So that the minimum of one second friction disk and the rotational connection arms can interact with each other across the largest possible surface area, it is proposed that the engagement openings be designed to extend essentially in the radial direction. Thus the engagement openings conform to the shape of the rotational connection arms.

The engagement openings can be limited radially on the inside by a ring-like area of the second friction disk, as a result of which the inner area of this second friction has a very sturdy configuration, as previously mentioned.

So that a very sturdy arrangement better suited to the handling of high torques can also

be provided in the area of the individual rotational connection arms, it is proposed that connecting areas be formed between the rotational connection arms arranged around the circumference of the hub to connect these arms to each other.

According to another aspect, the present invention pertains to a clutch disk arrangement for a friction clutch comprising a hub with a plurality of rotational connection arms extending essentially in the radially outward direction with respect to an axis of rotation and a plurality of friction disks, which are connected nonrotatably to the hub by the rotational connection arms in such a way that the disks can move in the axial direction with respect to the hub.

It is then also provided that at least one friction disk has engagement openings which are closed off at the radially inner ends, and that the rotational connection projections on the rotational connection arms of the hub engage in these openings.

It is obvious that a clutch disk arrangement of this type can have various groups of the features explained in detail above in the area of the hub or in the area of the second friction disks.

Another problem of the previously discussed state of the art is that the axial support or axial retention of the hub with respect to the friction disks to be connected nonrotatably to it is provided by parts or sections of the hub which are formed either radially outside on the rotational connection arms or which extend along the radial area of the rotational connection arms. These embodiments require a considerable amount of fabrication work, because these types of formations, as known from, for example, DE 198 35 199 C1, are produced by, for example, the wire erosion process. In addition, because these sections adjoin the rotational connection arms radially on the outside, the axial dimension of these rotational connection arms is reduced correspondingly, which means that there is a loss of strength in the rotational

connection between the hub and the friction disks to be connected to it.

According to another advantageous aspect, the present invention therefore provides a hub for a friction clutch, where the hub has a ring-like body area, from which a plurality of rotational connection arms arranged around the circumference project radially outward to establish the nonrotatable connection between the hub and the friction disks, and where the ring-like body area also forms at least one axial securing area, by which the hub is secured axially with respect to the friction disks.

In the hub designed in accordance with the invention, therefore, there is a clear-cut radial progression, according to which the rotational connection arms are situated radially outside the area which functions as axial support for the hub. This simplifies production significantly. In addition, a variant of this type makes it possible for the rotational connection arms to extend farther outward in the radial direction.

For example, it is possible for the radial dimension of the area of the ring-like body adjacent to the rotational connection arms to be smaller than the radial dimension of the rotational connection arms. This can be realized, for example, by providing a recess in at least one axial side of the ring-like body adjacent to the rotational connecting arms, where the bottom area of the this recess forms the axial securing area. As a result of this set-back or recessed area in the ring-like body area, it is also becomes possible, as already described above, for the friction disks which are to be connected to the hub or for at least parts of these disks to be closed radially on the inside, which means that they do not have sections which extend radially inward in a star-like manner as known in the state of the art. This radially inner closure increases the strength of the disk even more.

It is also possible, in the hub according to the invention, for a connecting section which

bridges the gap between the rotational connection arms to be formed between at least two of the rotational connection arms. The friction disks to be connected to the hub do not come into contact with these connecting sections. The important point here is that these connecting sections, which are situated in the radial area of the rotational connection arms, serve no axial securing function; on the contrary, they serve only to increase the strength in the area of the rotational connection arms. For this reason, it is possible, for example, for the axial dimension of the connecting sections to be smaller than that of the radial section of the ring-like body area which forms the minimum of one axial securing area.

According to another advantageous aspect, it is possible, in the hub according to the invention, for the radial area of the ring-like body which adjoins, radially on the inside, the radial area forming the minimum of one axial securing area, to have a rotational connection area for the nonrotatable connection of the hub to a shaft. It is therefore possible to see here a clear progression of the three different radial areas of the hub. The radially innermost area serves to connect the hub to a shaft; this is followed by the radial area by which the hub is supported axially with respect to the friction disks, and this is followed in turn by the area by which the hub is connected to the friction disks for rotation in common with them. These three areas are clearly separate from each other in the radial direction and have essentially no mutual overlap in the radial direction.

The present invention is described in detail below by reference to the attached drawings:

-- Figure 1 shows a longitudinal cross section through a friction clutch according to the invention;

-- Figure 2 shows an exploded view of the friction clutch appearing in Figure 1;

-- Figure 3 shows a longitudinal cross section through the clutch disk arrangement used in the friction clutch of Figure 1;

-- Figure 4 shows an axial view of the hub used in the clutch disk arrangement of Figure 3;

-- Figure 5 shows a cross-sectional view of the hub of Figure 4, cut along line V-V in Figure 4;

-- Figure 6 shows a perspective view of the hub appearing in Figure 4;

-- Figure 7 show a view similar to that of Figure 4 of a hub with an alternative design;

-- Figure 8 shows a cross-sectional view of the hub appearing in Figure 7, cut along line VIII-VIII in Figure 7;

-- Figure 9 shows a perspective view of the hub of Figure 7;

-- Figure 10 shows an axial view of a friction disk used in the clutch disk arrangement of Figure 3;

-- Figure 11 shows a perspective view of the friction disk appearing in Figure 10;

-- Figure 12 shows the friction disk appearing in Figure 10, cut along line XII-XII in Figure 10;

-- Figure 13 shows an axial view of a friction disk which is used in the friction clutch of Figure 1 and connected nonrotatably to the housing arrangement;

-- Figure 14 shows a perspective view of the friction disk of Figure 13; and

-- Figure 15 shows a cross-sectional view of the friction disk appearing in Figure 13.

Figures 1 and 2 show a friction clutch 10 according to the invention, i.e., a pressure plate assembly for such a clutch, in its entirety. The friction clutch 10 comprises a housing arrangement 12, which has an essentially ring-like housing bottom 14 on one axial side, from

which several web sections 16 distributed around the circumference proceed in the axial direction, relative to an axis of rotation A. The screw bolts 18 pass through axial openings in these web sections 16 and have end sections 20, which project beyond these web sections 15 so that they can be screwed into a flywheel (not shown), which can be connected rigidly to a drive shaft.

The radially outer area of an energy-storage device 24, designed as, for example, a diaphragm spring, is supported on the bottom area 14 of the housing 12 by way of wire ring 22 or the like. Farther inward in the radial direction, the energy-storage device 24 acts on a pressure plate 26. This plate has pairs of driver projections 28 on its outer circumference, which cooperate with several of the web sections 16; a web section 26 is designed to fit between the two projections of each pair. The pressure plate 26 is thus connected to the housing 12 for rotation in common around the axis of rotation A, but is still able to shift under the action of the energy-storage device 24 relative to the housing 12 in the direction parallel to the axis of rotation.

Four first friction disks 30a, 30b, 30c, 30d, furthermore, are connected nonrotatably to the housing 12, but also in such a way that they can shift in the direction parallel to the axis of rotation A. For this purpose, as will be described later in detail, these first friction disks 30a, 30b, 30c, 30d have recesses 32 in the outer circumference, in each of which a web section 18 is accepted. The arrangement of the first friction disks 30a, 30b, 30c, 30d is such that the friction disk 30a, positioned closest to the bottom area 14, is acted upon by the pressure plate 26, whereas the friction disk 30d, the farthest away from the bottom area 14, can be supported axially against the flywheel, which is rigidly connected to the housing 12. The backs of the two intermediate first friction disks 30b, 30c rest against each other. Between the first friction

disk 30a and the first friction disk 30b, there is a second friction disk 34a. There is also another second friction disk 34b between the first friction disk 30c and the first friction disk 30d. The two second friction disks 34a and 34b are essentially free to rotate with respect to the housing 12 and the first friction disks 30a, 30b 30c, 30d, but are connected nonrotatably to a hub 36 in such a way that they can shift relative to it in the axial direction, parallel to the axis of rotation A. The hub 36 has a set of internal wedge-shaped teeth 38, so that it can be connected nonrotatably to a transmission input shaft or the like in such a way that it can shift in the axial direction. In the engaged state, the pressure plate 26, upon which the energy-storage device 24 is exerting force, acts on the first friction disk 30a, which in turn presses against the second friction disk 34a. This second disk is supported axially against the first friction disk 30b, which in turn is supported axially against the first friction disk 30c without the possibility of any frictional action in the circumferential direction. In the engaged state of the clutch, the second friction disk 34b is then clamped frictionally between this disk and the other first friction disk 30d, the support in this case being provided by the contact between first friction disk 34d and the flywheel (not shown). Thus torque can be transmitted between the housing 12 and the hub 36. To release the clutch, a pulling force can be exerted on the radially inner ends of the spring tongues 40 of the energy-storage device 24 in order to reduce or to eliminate entirely the pressure being applied by the pressure plate 26 against the first friction disk 30a and thus to reduce or to eliminate entirely the frictional interaction present between the first friction disks 30a, 30b, 30d and the second friction disks 34a, 34b.

Figures 3-6 show the clutch disk arrangement 42 in detail, which consists essentially of the hub 36 and the two second friction disks 34a, 34b. It can be seen that, on the hub 36, proceeding from an essentially ring-like inner body area 44, which has the set of wedge-shaped

teeth 38 on its inner circumferential surface, a plurality of essentially radially oriented, axially stretched-out rotational connection arms 46 is provided. In their radially inner area, close to the body area 44, these rotational connection arms 46 have recesses 48, 50 in both axial sides, so that projections 52, 54, which extend in the axial direction radially outside these recesses 48, 50, are formed on the rotational connection arms 46. An area 56 of reduced axial dimension is thus created between the two recesses 48, 50.

Figures 3-6 clearly show an essential principle of the hub 36 designed according to the invention, which can be produced out of a single piece of material. This hub 36 can basically be divided into three separate radial areas. The first is a radially inner section 100 on the ring-like body area 36, which inner section extends essentially across the entire axial dimension of the hub, and which carries the set of wedge-shaped teeth 38 on its inner circumferential surface. The second elementary radial area is the section of the ring-like body area 44 in which the recesses 48, 50 are formed on both axial sides; this second section adjoins the section 100 radially on the outside. This area 56 is therefore much smaller in the axial direction than the radially inner area 100 and the third elementary radial section of the hub 36 according to the invention, namely, the radial section formed by the rotational connection arms 46. Each of these three radial sections serves an important function in the inventive hub 36. The radially inner, ring-like section 100 with the set of teeth 38 serves to connect the hub 36 to a hub for rotation in common. The adjoining section 56 with the two recesses 48, 50 radially outside this section 100 serves the function of axially securing or retaining the hub 36 with respect to the friction disks 34a, 36b previously described in reference to Figure 3 and thus with respect to the entire friction clutch, a function which is performed by the bottom areas 102, 104 of these recesses 48, 50, which bottom areas 102, 104 face essentially in the axial

direction. Thus the hub 36 is prevented from wandering within the friction clutch. The radially outermost section of the hub 36, formed by the rotational connection arms 46, serves to transmit torque between the hub 36 and the friction disks 34a, 34b, which at the same time secure the axial position of the hub 36 and possibly that of additional friction disks which could be positioned between these two hubs 34a, 34b and also connected nonrotatably to the hub 36. The result is that the axial dimension of the area 56 between the two bottom areas 102, 104 must correspond approximately to the axial dimension of the friction disks to be positioned between the two friction disks 34a, 34b. These disks would be both the friction disks, which are connected nonrotatably to the housing arrangement 12, and any other friction disks which may be positioned between them, i.e., disks connected nonrotatably to the hub 36.

It can also be concluded from the preceding description that there is essentially no overlap between the three radial sections (100, 56, 46) of the inventive hub 36. The area of the rotational connection arms 46 serves no axial support function, whereas the area of the recesses 48, 50 serves no connecting function for rotation in common. Thus each of the three areas 100, 56, 46 can be designed in the best possible way to serve its intended function.

Another advantage of the hub according to the invention is that it is very easy to manufacture from a single piece of material. For example, a ring-like blank can first be prepared, and then the rotational connection arms 46 can be produced by a simple milling procedure with a pin-type milling cutter or a solid cylindrical cutter. Next, material can be removed by another metal-cutting procedure such as turning on a lathe or cutting with a chisel to form the radially central area, namely, the area comprising the two recesses 48, 50. There is therefore no need for complicated processing methods such as wire erosion, for example.

Figures 11-12 show a second friction disk 34, which can be used in general as the

second friction disk 34a or as the second friction disk 34b, which are identical in design. This second friction disk 34, which can be made of a metal such as steel, aluminum, or titanium, has a radially outer, ring-like area 58, by which the disk interacts frictionally with the first friction disks assigned to it. Radially on the inside, adjacent to this ring-like area 58, are several essentially radial engagement openings 60, which, at their radially inner end, are closed off by another ring-like area 62. After the clutch arrangement 42 has been completely assembled, the projections 52, 54 of the rotational connection arms 46 of the hub 36 engage axially in these engagement openings 60 in the two second friction disks 34a, 34b, as can be seen in Figure 3. The shape of the engagement openings 60 is based essentially on the shape of the projections 52, 54, so that an essentially nonrotatable connection is produced between the second friction disk 34a, 34b and the hub 36. The hub 36 is secured in the axial direction by the two radially inner, ring-like areas 62 of the second friction disks 34a, 34b, between which the areas 56 of the rotational connection arms 46 between the recesses 48, 50 are positioned. Thus the hub 36 is prevented from migrating in either axial direction out of the area of the second friction disks 34a, 34b. It is obvious that the axial width of the area 56 must be adapted to the axial thickness of the two first friction disks 30b, 30c, so that, in the engaged state of the clutch, it is impossible for the inner ring-like areas 62 of the two second friction disks 34a, 34b to contact the area 56 before sufficient frictional contact with the first friction disks 30b, 30c has been produced externally.

The previously described design of the clutch disk arrangement 42 provides a very strong configuration. The primary reason for this is that the second friction disks 34a, 34b, which transmit torque to the hub 36, are closed radially on the inside. There is thus no danger that, during the transmission of very high torques, these two second friction disks 34a, 34b

could be subjected to deformation in the area where they are connected to the hub 36. At the same time, the ring-like areas 62, which ensure the effective stabilization of the second friction disk 34a, 34b, also keep the hub 36 in its intended axial position.

Figures 7-9 show a modified hub 36. The basic design is the same as that described previously. It can be seen here, however, that connecting sections 64, which are formed as an integral part of the hub 36, are provided between the rotational connection arms 46 arranged around the circumference. These connecting sections are located approximately in the axially center part of the arms, and extend radially outward, and also adjoin the area 56 between the two recesses 48, 50. These connecting sections extend radially approximately halfway up the center of the rotational connection arms 46 and thus reinforce the connections between these arms in the circumferential direction. As a result, an arrangement is created here, too, which is strengthened to handle the transmission of very high torques. To prevent an excessive increase in weight in this area as well, however, it is possible to provide openings 66 in the area of these sections 64. These openings can be formed there, for example, where the sections 64 adjoin the area 56 between two recesses 48, 50. It is obvious that the axial dimension or axial width of the sections 64 is shown only by way of example in Figures 7-9. These sections can, for example, extend all the way to the radially outer end area of the rotational connection arms 46 and can obviously also have a greater axial thickness, which, in the extreme case, can even be equal to the axial thickness of the areas 56. Basically, however, in the hub according to the invention, it is important that these connecting sections 64 do not serve any axial support function for the hub 36 against the friction disks 34a, 34b connected nonrotatably to it. This is the exclusive task of the radially inner area 56 adjoining the rotational connection arms 46. The sections 64 have the sole function of providing

circumferential stiffening between the individual rotational connection arms 46.

The design of a first friction disk 30 which can be used as one of the friction disks 30a, 30b, 30c, and 30d will be described below with reference to Figures 13-15. This first friction disk 30 has a ring-like carrier 68, made of metal, for example, in the radially outer area of which the previously mentioned recesses 32 for connection to the housing 12 for rotation in common are formed. The carrier 68, as can be seen especially clearly in Figure 5, can have a greater axial thickness in this radially outer area. Several friction lining segments 72, arranged in a row around the circumference, are connected to the ring-like area 70 of the carrier 68 located further inward in the radial direction. Clinch bolts 74 are the preferred means of connecting the friction lining segments 72, the heads of the bolts being countersunk below the surface of the segments. To ensure sufficient strength, each of the friction lining segments 72 can be connected by two of these clinch bolts 74.

The friction lining segments 72 used in this type of first friction disk 30 can be made of various materials; the selection depends, among other things, on the friction partner provided by the second friction disks 34. For example, carbon can be used as a friction lining material, in which case the second friction disks 34 are preferably also made of carbon. Ceramic or sintered metal materials can also be considered as friction lining material, in which case the preferred friction partners will then be metal disks, such as steel, aluminum, or titanium friction disks. Organic friction materials are also possible here, in which case steel, aluminum, or titanium friction disks are again preferred as the opposing friction partners.

As a result of the design described here, an arrangement is created in which, through the provision of the friction lining segments on the first friction disks and the formation of the second friction disks of comparatively light-weight material, the mass on the engine side is

increased, which makes it easier to synchronize the gearbox. Of course, the opposite arrangement is also possible, preferably when sufficient flywheel mass is present on the engine side, in which case friction lining segments are attached to the second friction disks and the first friction disks are designed as disks made of metal or carbon.

As a result of the present invention, a friction clutch or a clutch disk arrangement for such a clutch is provided, which, especially because of the way in which the second friction disks are connected to the hub for rotation in common, is able to handle very high torques. This is necessary or at least advantageous especially in the case of racing vehicles. To an increasing extent, however, drive systems used in ordinary vehicles are also generating very high torques. The inventive design in the area of the clutch disk arrangement is therefore especially advantageous, because the radius on which the second friction disks are connected to the hub for rotation in common is much smaller than the radius on which the first friction disks are connected to the housing for rotation in common, which means that there is usually much less room available for the elements which connect the friction disks to the hub.

CLAIMS

1. Friction clutch comprising:

-- a housing arrangement (12), which is or can be connected to a drive element for rotation in common around an axis of rotation (A);

-- a plurality of first friction disks (30a, 30b, 30c, 30d), which are connected to the housing arrangement (12) for rotation in common around the axis of rotation (A) and are able to shift relative to the housing arrangement (12) in the direction parallel to the axis of rotation (A);

-- a plurality of second friction disks (34a, 34b), which are connected to a hub (36) for rotation in common around the axis of rotation (A) and are able to shift relative to the hub (36) in the direction parallel to the axis of rotation (A), where the hub (26) has a plurality of radially outward-projecting rotational connection arms (46), which engage with the second friction disks (34a, 34b) for rotation in common with the hub (36); and

-- a force-exerting arrangement (24), under the action of which the first friction elements (30a, 30b, 30c, 30d) and the second friction elements (34a, 34b) can be brought into frictional contact with each other,

characterized in that at least one of the second friction disks (34a, 34b) has engagement openings (60) closed off radially on the inside, in which the rotational connection projections (52, 54) on the rotational connection arms (46) of the hub (36) engage.

2. Friction clutch according to Claim 1, characterized in that rotational connection projections (52, 54) are provided on both axial sides of the rotational connection arms (46), which projections engage in the associated engagement openings (60) in the two second friction

disks (34a, 34b).

3. Friction clutch according to Claim 1 or Claim 2, characterized in that the engagement openings (60) extend essentially in the radial direction.

4. Friction clutch according to one of Claims 1-3, characterized in that the engagement openings (60) are limited radially on the inside by a ring-like area (62) of the second friction disk (34a, 34b).

5. Friction clutch according to one of Claims 1-4, characterized in that connecting areas (64) are formed between the rotational connection arms (46) of the hub (36) arranged around the circumference to connect these arms together.

6. Clutch disk arrangement, especially for a friction clutch according to one of the preceding claims, comprising a hub (36) with a plurality of rotational connection arms (46), which, with respect to an axis of rotation (A), extend essentially in the radially outward direction, and a plurality of friction disks (34a, 34b), which are connected nonrotatably by means of rotational connection arms (46) to the hub (36) but which are still free to move in the axial direction relative to it, characterized in that at least one friction disk (34a, 34b) has engagement openings (60), which are closed radially on the inside, in which openings rotational connection projections (52, 54) on the rotational connection arms (46) of the hub (36) engage.

7. Hub, especially for a friction clutch according to one of Claims 1-5 or a clutch disk arrangement according to Claim 6, where the hub (36) has a ring-like body area (44), from which a plurality of rotational connection arms (46), arranged in a row around the circumference, extends radially outward to establish the nonrotatable connection of the hub (36) to the friction disks (34a, 34b), where the ring-like body area (44) forms at least one axial

securing area which secures the hub (36) axially in position with respect to the friction disks (34a, 34b).

8. Hub according to Claim 7, characterized in that the area (56) of the ring-like body area (44) adjacent to the rotational connection arms (46) has a smaller radial dimension than the rotational connection arms (46).

9. Hub according to Claim 7 or Claim 8, characterized in that the area (56) of the ring-like body area (44) adjacent to the rotational connection arms (46) has a recess (48, 50) on at least one axial side, where a bottom area (102, 104) of the recess (48, 50) forms an axial securing area.

10. Hub according to one of Claims 7-9, characterized in that, between at least two rotational connection arms (46), a connecting section (64) which bridges the gap between the two arms is formed, with which the friction disks (34a, 34b) to be connected nonrotatably to the hub do not come in contact.

11. Hub according to Claim 10, characterized in that the connecting section (64) has a smaller axial dimension than the ring-like body area (44) has in the radial area (56) forming the minimum of one axial securing area.

12. Hub according to one of Claims 7-11, characterized in that the radial area (100) of the ring-like body area (44), i.e., the area which is radially inside the radial area (52) forming the minimum of one axial securing section, has a rotational connection area for the nonrotatable connection of the hub (36) to a shaft.

ABSTRACT

A friction clutch comprising

-- a housing arrangement (12), which is or can be connected to a drive element for rotation in common around an axis of rotation (A);

-- a plurality of first friction disks (30a, 30b, 30c, 30d), which are connected to the housing arrangement (12) for rotation in common around the axis of rotation (A) and are able to shift relative to the housing arrangement (12) in the direction parallel to the axis of rotation (A);

-- a plurality of second friction disks (34a, 34b), which are connected to a hub (36) for rotation in common around the axis of rotation (A) and are able to shift relative to the hub (36) in the direction parallel to the axis of rotation (A), where the hub (26) has a plurality of radially outward-projecting rotational connection arms (46), which engage with the second friction disks (34a, 34b) for rotation in common with the hub (36); and

-- a force-exerting arrangement (24), under the action of which the first friction elements (30a, 30b, 30c, 30d) and the second friction elements (34a, 34b) can be brought into frictional contact with each other, is characterized in that at least one of the second friction disks (34a, 34b) has engagement openings (60) closed off radially on the inside, in which the rotational connection projections (52, 54) on the rotational connection arms (46) of the hub (36) engage.

(Figure 1)

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